RECEIVED
JUL 24 1946
O. S. U. LIBRARY

I. C. 7359

JUNE 1946

UNITED STATES
DEPARTMENT OF THE INTERIOR
J. A. KRUG, SECRETARY

BUREAU OF MINES
R. R. SAYERS, DIRECTOR

INFORMATION CIRCULAR

COAL-MINE EXPLOSIONS AND COAL- AND METAL-MINE FIRES IN THE UNITED STATES DURING THE FISCAL YEAR ENDED JUNE 30, 1945

BY

D. HARRINGTON, W. J. FENE, AND
H. B. HUMPHREY

Generated on 2024-09-19 16:53 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

I. C. 7359,
June 1946.

INFORMATION CIRCULAR

UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

COAL-MINE EXPLOSIONS AND COAL- AND METAL-MINE FIRES IN THE UNITED STATES DURING THE FISCAL YEAR ENDED JUNE 30, 1945[1]

By D. Harrington,[2] W. J. Fene,[3] and H. B. Humphrey[4]

The number of fatalities from mine explosions for the fiscal year 1945 dropped below that of the year before; continued improvement over the record of the years from 1940 to 1945 is hopeful, but the number of reported explosions has increased rather than diminished, and the number of victims claimed by explosions is often more definitely a factor of chance than forethought. Mine fires and explosions can be eliminated through the methods now well-known to those well-informed in matters pertaining to safety in mining but ignored by many coal-mine operators and employees who follow procedures of the past or their own short cuts, regardless of disasters that may result. Tried and proved safety measures for preventing mine fires and explosions have been recommended to the mining public repeatedly, yet only a relatively small but far-sighted minority have adopted these measures and made them a part of operating practice. That far more explosion disasters did not occur in 1945 is fortunate.

In 1945 a coal-mine fire of electrical origin caused heavy loss of life, while several others from the same cause were controlled with but few fatalities; this hazard is now being curbed temporarily to some degree after the bad record of the two preceding years, but a real solution of the problem has not been reached, although cooperating committees trying to produce at least some answer have made progress.

During the fiscal year 1945, 34 explosions in coal mines resulted in 64 fatalities, compared with an average of 24 explosions and 153 fatalities per year during the preceding 5 years. Thirty-two underground coal-mine fires during the year resulted in 71 fatalities. The average for the preceding 5 years has been 26 fires and 10 fatalities a year.

SUMMARY OF MINE EXPLOSIONS, BY STATES AND CAUSES

Essential data on 34 coal-mine explosions occurring in 12 States and resulting in 64 deaths during the fiscal year ended June 30, 1945, are shown in table 1. The table summarizes the information on all coal-mine explosions during the fiscal year that were brought to the attention of the Bureau of Mines and is believed to cover every explosion in which life was lost or

---

1/ The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is made: "Reprinted from Bureau of Mines Information Circular 7359."

2/ Chief, Health and Safety Branch, Bureau of Mines, Washington, D. C.

3/ Assistant chief, Coal Mine Inspection Division, Bureau of Mines, Washington, D. C.

4/ Mining engineer, Washington, D. C.

Generated on 2024-09-19 16:50 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

considerable damage was done. There were 11 more explosions than were listed in the previous year, but some were of a relatively minor nature; the number of deaths (64) was 30 less than in 1944.

Explosions in Utah coal mines killed the greatest number (31), followed by Oklahoma with 10 deaths from this cause and New Mexico with 6. In the eastern coal regions, Pennsylvania and Kentucky each had 5 deaths from coal-mine explosions, Alabama 3, Virginia 2, and Illinois and Indiana 1 each. An explosion in Washington and 1 in West Virginia did not cause any deaths although 4 men were burned and a serious fire resulted in the West Virginia mine.

The 4 major explosions during the fiscal year resulted in 45 deaths compared with 5 major explosions with 81 deaths in 1944 and 5 major explosions with 122 deaths in 1943. A major explosion is one in which 5 or more fatalities occur. Of the 34 explosions known to have occurred in the past fiscal year, 17 caused no fatalities. Two of the major explosions were in Utah coal mines, 1 in New Mexico, and 1 in Oklahoma; this record indicates laxity in carrying out safety measures to prevent explosions or reduce their seriousness in the coal mines of those regions. The anthracite mines of Pennsylvania experienced 7 known gas ignitions, 3 of which caused fatalities; bituminous mines of the same State and 4 ignitions, 1 of which resulted in 2 deaths, the others causing no fatalities. These 2 fatalities were the only deaths reported from explosions in the large bituminous-coal fields of Pennsylvania and West Virginia for the year; for the first time in over 17 years, West Virginia coal mines operated without a fatality from explosions during a fiscal year.

The causes of explosions that occurred during fiscal years 1929 to 1945, as determined from records of the Health and Safety Branch of the Bureau of Mines, are summarized in table 2. In the fiscal year 1945, 20 persons were killed in explosions initiated by electricity compared with 59 the year before and an average of 64.1 for the preceding 10 years. During the fiscal year 1945, 4 explosions from electricity in Pennsylvania caused 3 deaths; 2 in Virginia 2 deaths; 1 in Utah 7 deaths; 1 in New Mexico 6 deaths; 1 in Oklahoma and 1 in Indiana 1 death each; and 1 in Kentucky and 1 in West Virginia no deaths.

Open lights or smoking caused 8 explosions in the fiscal year 1945 compared with 6 in the previous year and with an average of 9.5 during the previous 10 years. Four deaths resulted from explosions caused by open lights or smoking during 1945 compared with 5 from this cause in 1944 and an average of 20.9 for the preceding 10 years. Pennsylvania had 5 explosions with 1 death caused by open lights or smoking; Alabama had 2 explosions with 3 deaths; and Indiana 1 with no deaths. In 5 of these explosions gas was ignited by miners attempting to smoke; in 2, gas was ignited by carbide lamps; and in 1, gasoline vapor was ignited by a carbide light while the tank of a gasoline-powered mine pump was being filled.

During the fiscal year 1945, 11 explosions resulting in 17 deaths were caused by explosives, compared with 3 such explosions in 1944 and an average of 2.6 explosions from this cause and 17.7 deaths for the previous 10 years.

Generated on 2024-09-19 16:55 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 16:52 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

I.C. 7359

TABLE 1. - Summary of coal-mine explosions, by States and causes, fiscal year ended June 30, 1945

State	Lighting used			Fatalities, by causes of ignition									
				Electricity		Open lights or smoking		Explosives		Miscellaneous		Total	
	Open	Closed	Unknown	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions
Alabama	1	2	-	-	-	3	2	-	-	-	1	3	3
Illinois	1	-	-	-	-	-	-	1	1	-	-	1	1
Indiana	-	2	-	1	1	-	1	-	-	-	-	1	2
Kentucky	4	1	1	-	1	-	-	5	5	-	-	5	6
New Mexico ..	-	1	-	6	1	-	-	-	-	-	-	6	1
Ohio	-	1	-	-	1	-	-	-	-	-	-	-	1
Oklahoma	-	2	-	1	1	-	-	9	1	-	-	10	2
Pennsylvania.	-	10	1	3	4	1	5	1	2	-	-	5	11
Utah	-	3	-	7	1	-	-	1	1	23	1	31	3
Virginia	-	2	-	2	2	-	-	-	-	-	-	2	2
Washington ..	-	1	-	-	-	-	-	-	1	-	-	-	1
West Virginia	-	1	-	-	1	-	-	-	-	-	-	-	1
Total...	6	26	2	20	13	4	8	17	11	23	2	64	34

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 16:52 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

TABLE 2. - Summary of data on explosions, by causes, fiscal years 1929-45, inclusive

Year	Lighting used			Fatalities, by ignition causes									
				Electricity		Open lights or smoking		Explosives		Miscellaneous or unknown		Total	
	Open	Closed	Unknown	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions
1929	17	19	1	93	18	14	10	26	8	6	1	139	37
1930	8	23	1	147	16	21	8	24	6	-	2	192	32
1931	12	14	-	131	8	56	11	18	6	-	-	205	25
1932	15	15	3	11	10	33	15	42	5	1	2	87	32
1933	6	14	1	25	8	63	7	29	4	5	2	122	21
1934	9	14	3	21	10	2	9	2	3	3	4	28	26
1935	5	17	-	29	10	6	8	3	2	16	2	54	22
1936	15	9	1	20	5	10	17	4	1	4	2	38	25
1937	4	12	4	53	12	3	5	-	1	6	2	62	20
1938	10	16	3	24	10	77	11	61	6	8	2	170	29
1939	2	12	-	13	9	2	3	-	-	1	2	16	14
1940	6	11	1	99	6	2	5	103	5	2	2	206	18
1941	5	21	-	145	14	15	9	3	3	-	-	163	26
1942	5	17	-	133	14	3	2	2	2	14	4	152	22
1943	11	17	4	66	19	86	9	-	3	-	1	152	32
1944	6	12	5	59	11	5	6	1	3	29	3	94	23
1945	6	26	2	20	13	4	8	17	11	23	2	64	34
Total	142	269	29	1,089	193	402	143	335	69	118	33	1,944	438

Original from THE OHIO STATE UNIVERSITY

Two explosions occurring in the 1945 fiscal year are listed under miscellaneous causes. One explosion resulting in 23 deaths is thought to have occurred through unsafe use of a flame safety lamp in the presence of gas; the other, resulting in injury to 4 miners but no deaths was caused when an attempt was made to relight a flame safety lamp with a match in the presence of gas.

The record of explosions, for the past 17 fiscal years, by States, is shown in table 3. During these years, 438 mine explosions caused 1,944 deaths, an average of 25.76 explosions and 114.35 deaths per year. During the fiscal year 1945 the number of explosions (34) was greater than the average for the previous 16 years, but the number of fatalities resulting from those explosions was less than the average. Over these 17 years, Pennsylvania had the greatest number of explosions - 119 with 322 deaths; West Virginia had 72 explosions with 381 deaths; Ohio with 17 explosions had 209 deaths; and Oklahoma with 23 explosions had 152 killed. Kansas has not had an explosion since 1929; Maryland has not had one since 1932; and Wyoming last had one in 1938.

The average number of deaths per explosion during the past 17 years has been 4.44. The lowest rate was 1.00 for Maryland, the highest 74.00 for Montana. Other States with high averages were: Ohio, 12.29; Virginia, 7.23; and Utah and Alaska (Terr.), 7.00. Coal producing States that are not known to have had an explosion during the past 17 years are Iowa, Michigan, Missouri, North Dakota, and Texas.

CAUSES OF EXPLOSIONS

Data are given in table 4 on causes of explosions in United States coal mines during the past 17 years as reported to the Bureau of Mines. During that period, 438 explosions were studied, an average of 25.8 per year. The total of 34 explosions in the fiscal year 1945 was 11 more than in the previous year and 9 more than the average of the preceding 16 years.

Table 4 shows that electricity was responsible for 193 (44.1 percent) and open lights and smoking for 143 (32.6 percent) of the explosions recorded during the 17 years; thus, 76.7 percent of all known explosions occurring in the past 17 years were started by these causes. During the 5 years from 1941 to 1945, 76.6 percent of the reported explosions were attributed to these causes, indicating strongly that effective precautions are still not being used against these hazards, since neither the number of explosions nor the resulting fatalities per year have been reduced in the 5-year period as compared with the preceding 12 years.

The number of explosions of electrical origin in the fiscal year 1945 (13) was a little more than the average for the preceding 16 years (11.4). Explosions from open lights and smoking (8) about equaled the previous 16-year average in number (8.4).

The number of explosions caused by blasting and the use of explosives (11) was greater than in any of the preceding 16 years and three times the average for those years (3.6).

Generated on 2024-09-19 16:52 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 16:56 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 3. - Record of explosions, by States, during fiscal years 1929-44, inclusive

	1929 to 1933		1934		1935		1936		1937		1938		1939		1940		1941		1942		1943		1944		1945		Total 17 years		Average per year		Average deaths per ignition
	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	
Alabama	25	18	2	2	-	1	-	1	-	-	37	2	-	1	1	4	6	5	11	1	12	3	29	3	3	3	126	44	7.41	2.59	2.86
Alaska	-	-	-	-	-	-	-	-	-	-	14	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	14	2	.82	.12	7.00
Arkansas	-	-	-	-	-	-	-	-	5	1	4	4	-	-	3	1	10	1	8	2	5	4	6	4	-	-	41	17	2.41	1.00	2.41
Colorado	5	5	-	-	-	-	12	2	1	1	-	-	-	-	1	1	2	1	34	2	3	1	1	2	-	-	59	15	3.47	.88	3.93
Illinois	69	10	-	-	-	-	-	-	-	-	5	2	1	1	1	1	-	1	8	1	1	2	-	-	1	1	86	19	5.06	1.12	4.53
Indiana	32	3	-	-	-	-	2	3	-	-	22	2	-	-	-	-	16	3	-	-	-	1	-	-	1	2	73	14	4.29	.82	5.21
Kansas	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	.12	.06	2.00
Kentucky	56	7	-	1	1	1	9	1	-	-	-	2	1	1	28	1	-	-	16	2	10	4	14	2	5	6	140	28	8.24	1.65	5.00
Maryland	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	.06	.06	1.00
Montana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	74	1	-	-	-	-	74	1	4.35	.06	74.00
New Mexico	22	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	1	28	5	1.65	.29	5.60
Ohio	92	8	-	-	-	-	4	1	-	-	2	1	-	-	72	1	32	2	-	-	7	3	-	-	-	1	209	17	12.29	1.00	12.29
Oklahoma	120	9	-	-	3	2	-	-	3	1	-	-	1	1	2	1	1	1	5	2	7	3	-	1	10	2	152	23	8.94	1.35	6.61
Pennsylvania	125	36	16	14	24	11	8	10	14	5	30	7	3	3	-	2	76	5	5	5	1	4	15	6	5	11	322	119	18.94	7.00	2.71
Tennessee	-	3	-	-	-	-	-	-	-	1	-	-	-	-	1	1	1	2	-	2	10	1	1	1	-	-	13	11	.76	.65	1.18
Utah	31	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	31	3	63	9	3.71	.53	7.00
Virginia	56	4	2	3	18	2	-	-	2	1	46	3	4	1	1	1	-	-	-	-	-	1	-	-	2	2	131	18	7.71	1.06	7.23
Washington	19	5	-	2	-	-	-	4	1	2	-	1	-	2	1	2	-	-	-	1	-	1	-	-	-	-	21	20	1.24	1.18	1.05
West Virginia	90	28	8	4	5	4	3	3	36	8	5	3	6	4	95	2	18	4	65	4	22	4	28	3	-	1	381	72	22.41	4.24	5.29
Wyoming	-	-	-	-	3	1	-	-	-	-	5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	2	.47	.12	4.00
Total	745	147	28	26	54	22	38	25	62	20	170	29	16	14	206	18	163	26	152	22	152	33	94	23	64	34	1,944	438	114.35	25.76	4.44

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 16:52 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 4. - Comparison of explosions by ignition causes, fiscal years 1929-45

Year	Ignition by electricity		Ignition by open lights or smoking		Ignition by explosives		Ignition due to unknown or miscellaneous causes		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1929...	18	48.7	10	27.0	8	21.6	1	2.7	37	100
1930...	16	50.0	8	25.0	6	18.8	2	6.2	32	100
1931...	8	32.0	11	44.0	6	24.0	-	-	25	100
1932...	10	31.3	15	46.9	5	15.6	2	6.2	32	100
1933...	8	38.1	7	33.3	4	19.1	2	9.5	21	100
1934...	10	38.5	9	34.6	3	11.5	4	15.4	26	100
1935...	10	45.4	8	36.4	2	9.1	2	9.1	22	100
1936...	5	20.0	17	68.0	1	4.0	2	8.0	25	100
1937...	12	60.0	5	25.0	1	5.0	2	10.0	20	100
1938...	10	34.5	11	37.9	6	20.7	2	6.9	29	100
1939...	9	64.3	3	21.4	-	-	2	14.3	14	100
1940...	6	33.3	5	27.8	5	27.8	2	11.1	18	100
1941...	14	53.8	9	34.6	3	11.6	-	-	26	100
1942...	14	63.6	2	9.1	2	9.1	4	18.2	22	100
1943...	19	59.4	9	28.1	3	9.4	1	3.1	32	100
1944...	11	47.9	6	26.1	3	13.0	3	13.0	23	100
1945...	13	38.2	8	23.5	11	32.4	2	5.9	34	100
Total..	193	44.1	143	32.6	69	15.8	33	7.5	438	100
Average	11.4	44.1	8.4	32.6	4.1	15.8	1.9	7.5	25.8	100

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The two explosions listed under miscellaneous causes have already been discussed: They were due to misuse of flame safety lamps - one resulting in 23 deaths, the other in injury to 4 miners.

EXPLOSION FATALITIES, BY CAUSES

The comparison of explosion fatalities by causes, given in table 5, shows that during the past 17 years 1,944 fatalities resulted from mine explosions in the United States, an average of 114.4 a year. In the fiscal year 1945 explosion fatalities (64) were 30 fewer than during the previous year (94) and approximately half of the average for the preceding 16-year period (117.5). Four major explosions in 1945 resulted in 45 deaths and 29 minor explosions caused 19 deaths, in comparison with the record for 1944, when 5 major explosions occurred with 81 deaths and 18 minor explosions with 13 deaths.

Explosions of electrical origin were responsible for 20 (31.3 percent) deaths in 1945, about one-third of the deaths (59) from this cause in 1944, and less than one-third of the average of 66.7 deaths for the preceding 16 years. The decrease in fatalities from explosions of electrical origin may indicate that better control is being exercised to limit the consequences of such explosions, even though the number of explosions is not being reduced; the actual facts will be determined by the cumulative record of succeeding years.

Explosions from open lights and smoking resulted in 4 deaths (6.2 percent of the explosion fatalities for the fiscal year 1945) compared with 5 deaths (5.3 percent) for the fiscal year 1944 and an average of 24.6 deaths for the 16 preceding years. Two ignitions of gas, caused by smoking, resulted in 4 deaths, while 3 other ignitions caused injuries but no fatalities. Three explosions from open lights caused burns and other injuries but did not result in death. If the dangers of open lights and smoking are not known to every man who works in a coal mine, they should be since explosions due to them have caused an average of 2 fatalities a month year after year. The record is made worse by the fact that smoking and carrying open lights underground are practised in fewer mines each year. Sole reliance for the prevention of explosions should not be placed either on ventilation or elimination of open flames; for even reasonable safety, both precautions should be taken; therefore both operators and miners have responsibilities to see that these sources of ignition are excluded from all coal mines. The operator has the primary responsibility to install closed lights, and their installation should not be opposed by the miners as occurs far too frequently, notwithstanding the fact that open lights are both unsafe and inefficient. The elimination of smoking underground is the joint responsibility of operators and miners; an operator's responsibility is to establish no-smoking rules and to endeavor to see that they are enforced and a miner's responsibility to refrain from smoking while underground and to see that his fellow miners do likewise.

Explosions caused by explosives caused 335 deaths in the past 17 years or 17.2 percent of all explosion fatalities. During the fiscal year 1945, 11 explosions and 17 deaths resulted from this cause; 1 with 9 deaths, 1 with 3, 5 with 1 death each, and 4 with no deaths. In comparison, there were 3 explosions and 1 death from this cause in 1944 and an average of 21.1 deaths for the preceding 16 years.

Generated on 2024-09-19 16:58 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 16:56 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 5. - Comparison of explosion fatalities, by causes of ignition, fiscal years 1929-45, inclusive

Year	Ignition by electricity		Ignition by open lights or smoking		Ignition by explosives		Ignition due to unknown or miscellaneous causes		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1929...	93	66.9	14	10.1	26	18.7	6	4.3	139	100
1930...	147	76.6	21	10.9	24	12.5	-	-	192	100
1931...	131	63.9	56	27.3	18	8.8	-	-	205	100
1932...	11	12.7	33	37.9	42	48.3	1	1.1	87	100
1933...	25	20.5	63	51.6	29	23.8	5	4.1	122	100
1934...	21	75.0	2	7.1	2	7.1	3	10.8	28	100
1935...	29	53.7	6	11.1	3	5.6	16	29.6	54	100
1936...	20	52.6	10	26.4	4	10.5	4	10.5	38	100
1937...	53	85.5	3	4.8	-	-	6	9.7	62	100
1938...	24	14.1	77	45.3	61	35.9	8	4.7	170	100
1939...	13	81.3	2	12.5	-	-	1	6.2	16	100
1940...	99	48.3	2	1.0	103	49.7	2	1.0	206	100
1941...	145	89.0	15	9.1	3	1.9	-	-	163	100
1942...	133	87.5	3	2.0	2	1.3	14	9.2	152	100
1943...	66	43.4	86	56.6	-	-	-	-	152	100
1944...	59	62.8	5	5.3	1	1.1	29	30.8	94	100
1945...	20	31.3	4	6.2	17	26.6	23	35.9	64	100
Total..	1,089	56.0	402	20.7	335	17.2	118	6.1	1,944	100
Average	64.1	56.0	23.6	20.7	19.7	17.2	6.9	6.1	114.4	100

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

CAUSES OF EXPLOSIONS OF ELECTRICAL ORIGIN

Table 6 gives data available to the Bureau of Mines on causes of explosions of electrical origin in the United States for the past 17 years. During this period there are known to have been 193 explosions of electrical origin; 13 of these, with 20 deaths, occurred during the fiscal year 1945.

Trolley or cable-reel locomotives and nonpermissible mining machines together were responsible for 46.2 percent of the explosions of electrical origin in 1945 as compared with 47.2 for the 17-year period.

During the past year nonpermissible mining machines caused four explosions, trolley or cable-reel locomotives, cable nips or blown-out calbes, and electric arcs 2 each, and nonpermissible electric motors, drills, and storage-battery locomotives one each.

Coal-mine explosions of electrical origin during the past 17 years have shown evidence of carelessness and disregard of simple, fundamental, well-known safe practices, including: (1) Failure to test for gas before electrical equipment is taken into working places or failure to test from time to time while the equipment is in use; (2) use of electrical equipment too soon after the mine fan has been started after a shut-down; (3) failure to examine a mine properly on idle days when only a small crew is in the mine; (4) use of haulageways as return airways; (5) failure to install permissible electric equipment or to maintain permissible equipment in a safe or permissible condition; (6) haphazard methods of attaching cable nips to power wires or of splicing cable; and other careless practices involving use of electrical equipment without taking into consideration due regard for adequate ventilation. The average number of explosions of electrical origin in the years 1936-40 was 8.4 per year; from 1941-45 it has been 14.2. Much greater care in maintaining efficient ventilation, testing for gas, and restricting the installation and use of nonpermissible equipment is absolutely necessary if explosions from electricity are to be prevented.

COMPARISON OF LIGHTING IN MINES WHERE EXPLOSIONS OCCURRED

The method of lighting used in mines where explosions occurred during the past 17 years is indicated in table 7. Of the 438 explosions during these years, 143 (32.7 percent) were in open-light mines, 266 (60.7 percent) in closed-light mines, and 29 (6.6 percent) in mines in which the lighting practice is unknown. During the fiscal year 1945, 6 (17.6 percent) occurred in open-light mines compared with an average of 8.6 explosions per year in open-light mines during the previous 16 years and an average of 6.6 per year for the preceding 5 years.

Generated on 2024-09-19 16:59 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 16:53 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 6. - Electrical causes of explosions, fiscal years 1929-45, inclusive

Type of equipment	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	Total 16 years	Number killed, 1944	Number killed, 1945
Trolley or cable-reel locomotive...	4	5	1	1	4	5	3	1	5	4	3	-	3	1	-	5	2	47	14	2
Nonpermissible mining machine	4	5	3	3	1	-	2	1	3	3	-	2	4	2	4	3	4	44	3	2
Nonpermissible electric motor	4	3	-	-	-	-	2	-	-	1	2	-	1	-	2	1	1	17	14	-
Nonpermissible shot-firing battery or circuit	-	1	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
Cable nips or blown-out cable	-	2	-	-	-	1	-	-	1	-	1	-	1	-	1	-	2	9	-	1
Nonpermissible electric drill	-	-	-	2	-	1	2	-	-	-	2	2	3	1	5	1	1	20	-	1
Nonpermissible storage-battery locomotive...	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3	-	6
Nonpermissible electric hoist	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Faulty wiring.	2	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	4	-	-
Trolley wire..	1	-	2	1	-	-	-	1	-	-	-	-	1	2	-	-	-	8	-	-
Electric arc..	2	-	1	2	1	2	1	2/1	1	2	1	2	1	8	7	1	2	35	28	8
Signal wire...	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	2	-	-
Total ...	1/18	2/16	8	10	8	10	10	5	12	10	9	6	14	14	19	11	13	193	59	20

1/ 1 explosion possibly due to a trolley locomotive and 1 possibly due to a nonpermissible mining machine arc not not included in this total.

2/ 2 explosions possibly due to nonpermissible shot-firing units or circuits not included in this total.

3/ Included, but may have been from smoking.

1013

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 16:59 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 7. - Summary of lighting in mines where explosions occurred, fiscal years 1929-45, inclusive

Year	Open lights		Closed lights		Lighting unknown		Total	
	Explosions	Percent	Explosions	Percent	Explosions	Percent	Explosions	Percent
1929	17	45.9	19	51.4	1	2.7	37	100
1930	8	25.0	23	71.9	1	3.1	32	100
1931	12	48.0	13	52.0	-	-	25	100
1932	15	46.9	14	43.7	3	9.4	32	100
1933	7	33.3	13	61.9	1	4.8	21	100
1934	9	34.6	14	53.9	3	11.5	26	100
1935	5	26.1	17	73.9	-	-	22	100
1936	15	60.0	9	36.0	1	4.0	25	100
1937	4	20.0	12	60.0	4	20.0	20	100
1938	10	34.5	16	55.2	3	10.3	29	100
1939	2	14.3	12	85.7	-	-	14	100
1940	6	33.3	11	61.1	1	5.6	18	100
1941	5	19.2	21	80.8	-	-	26	100
1942	5	22.7	17	77.3	-	-	22	100
1943	11	34.4	17	53.1	4	12.5	32	100
1944	6	26.1	12	52.2	5	26.1	23	100
1945	6	17.6	26	76.5	2	5.9	34	100
Total	143	32.7	266	60.7	29	6.6	438	100

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

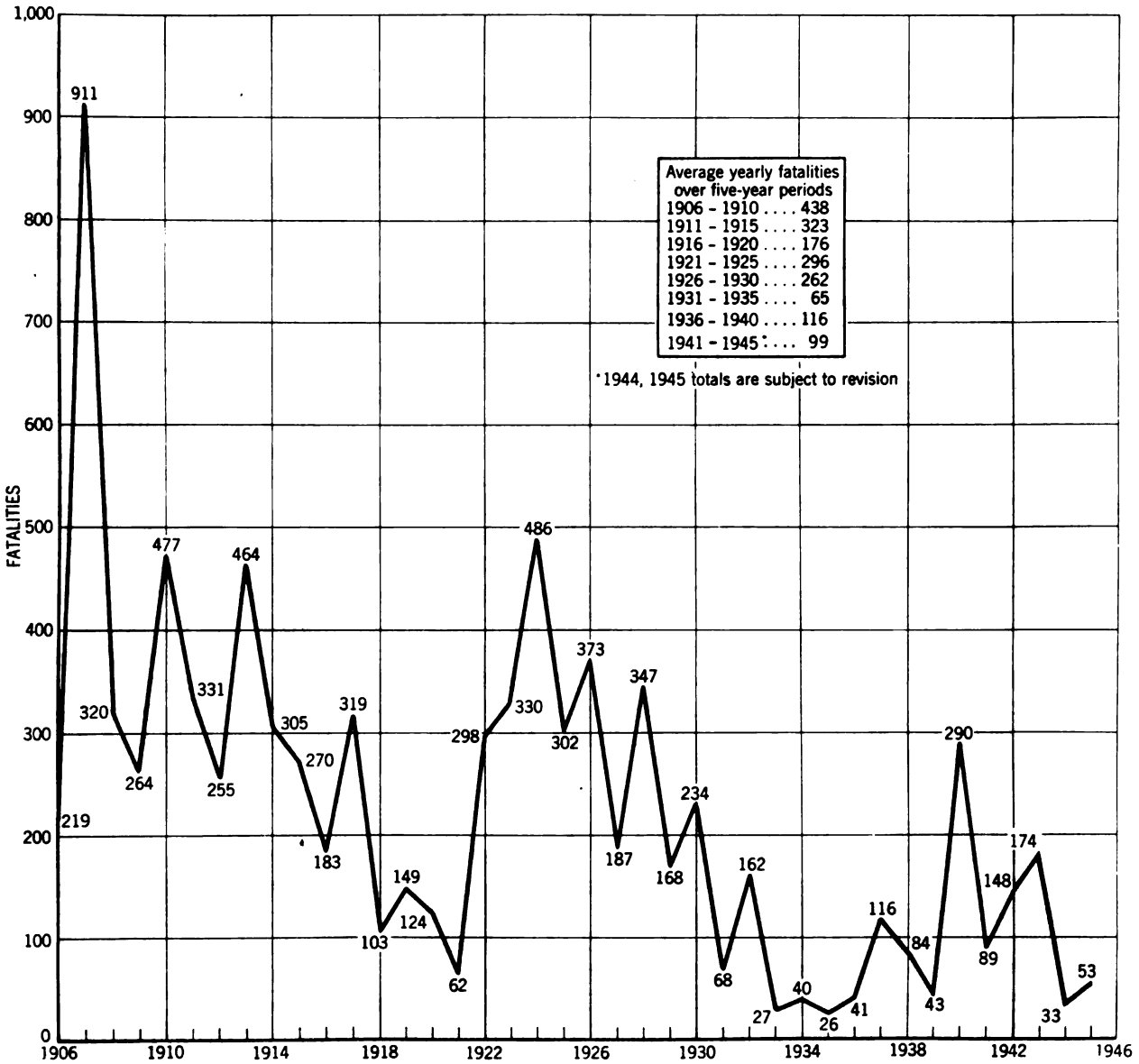

FIGURE 1.- Fatalities from gas- and coal-dust explosions in bituminous-coal mines.

Generated on 2024-09-19 16:51 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

In the past year 76.5 percent of the explosions occurred in closed-light mines compared with 64.5 percent for the preceding 5 years and 61.9 percent for the preceding 16 years. This increasing proportion of explosions in mines where closed lights only are used may be interpreted in several ways. Probably the most nearly correct explanation is that in many States most of the gassy mines now use closed lights. All coal mines are potentially gassy, and it is in the so-called nongassy mines that a large percent of the explosions occur. No explosion is known ever to have been caused by an electric cap lamp; this indicates that almost unquestionably there has been carelessness in other explosion-prevention practices in closed-light mines. The increasing percentage of explosions in these mines may indicate that a greater percentage of mines each year adopt closed lights. Explosions have occurred in mines that have adopted closed lights and then placed too much dependence on the lamps, with the result that ventilation and other precautionary measures are neglected. Among the bad practices followed in mines or parts of mines known to give off explosive gas and placed on a closed-light basis is the use of open-type electrical equipment (pumps, drills, cutting machines, loading machines, conveyor motors, and other units), a flagrant violation of sane mining practice that is inexcusable. Many explosions in both open- and closed-light mines are due to conditions brought about by the use of blower fan-tubing systems of ventilation. Frequently, smoking is practiced in closed-light mines, sometimes with the consent of the management but more often through violation of company rules or State laws or regulations. Use of up-to-date permissible electric cap lamps is one of the most effective means now known of increasing the safety of work in mines, and any individual or agnecy failing to use or trying to prevent the use of electric cap lamps in mines is woefully ignorant of the requirements for safety in mines or is deliberately indifferent to the operation of mines on anything approaching an efficient or humanitarian basis. On the other hand, any neglect of other essential safety procedures through placing undue reliance on electric cap lamps is bound to result in disaster sooner or later; such neglect carries with it a responsibility analogous to such violation of law as smoking in closed-light mines.

EXPLOSIONS IN BITUMINOUS-COAL MINES

Figure 1 shows the trend of fatalities resulting from gas and dust explosions in bituminous-coal mines of the United States during the calendar years 1906 to 1945, inclusive. The figures for 1944 and 1945 are preliminary and subject to final revision. The trend of explosion fatalities was downward from 1907 to 1921, with a marked rise from 1922 to 1924 and a definite and relatively steady decline from 1924 to 1935; an upward trend from 1936 to 1943, with especially high occurrence of fatalities in 1940 and 1943, has dropped again in 1944 and 1945. If the relatively low number of fatalities in the past 2 years is reduced in the next year or 2, it is reasonable to assume that progress has been made in controlling and possibly in eliminating the danger of death from explosions in coal mines. It is significant that, in every alternate year from 1924 to 1936, the number of deaths increased over that of the preceding year, although the general trend was downward. A plausible explanation is that a year with a relatively low explosion-fatality record causes relaxation in efforts to prevent explosions during the following year; conversely, a year with a high explosion-fatality record causes additional precautionary measures to be taken. The trend for the last several

Generated on 2024-09-19 16:59 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

years does not bear out this relationship so exactly as in the period mentioned, possibly because of other factors not clearly apparent. The trend of explosion fatalities is illustrated in another way by the tabulation on the graph of average annual fatalities for 5-year periods from 1906-10 to 1941-45, which shows a large decrease in average annual fatalities from 438 for the 1906-10 period to 176 for that of 1916-20; a rise to 296 for the 5-year period 1921-25 dropped to 65 for the 1931-35, followed by 116 for 1936-40 and approximately 99 for 1941-45. The good record for 1931-35 gave hope that disastrous mine explosions in the United States had been largely eliminated, but the record for the next 5 years proved this hope to be unfounded. The improvement of the last 2 years is encouraging, but more time must pass before the coal-mining industry can be confident that this improvement is less temporary than in the past. Several factors have contributed to the bad record of the past several years, such as (1) the rapid increase in the use of electrical equipment at face regions where gas and dust are most likely to be found; (2) the increased demand for coal, with the desire to obtain maximum tonnage per machine at minimum cost, which in many mines has resulted in neglect of even rudimentary precautionary measures; (3) multiple-shift operation without provision of time for adequate maintenance of equipment, effective rock dusting, and testing for gas; (4) decrease in supervision owing to demands on supervisors for maximum tonnage and loss of competent supervisors to other employment; (5) lack of effective supervision owing to numerous new conditions, some of them war-connected; (6) inability to obtain adequate equipment repair and replacement parts; (7) shortage of labor and inadequate training of coal-mine workers; and (8) failure of both miners and mining officials to show regard for safety in changing from hand-loading to mechanized methods.

MINE FIRES

During the past fiscal year 32 coal-mine fires, which resulted in the death of 71 men, were called to the attention of the Bureau. One fire disaster resulted in 66 deaths, 5 fires caused 1 death each, and 26 others did not result in a fatality. Five underground fires in metal mines resulted in loss of production and property, and some caused heavy damage to the mine but no loss of life occurred.

Table 8 shows that, of the coal-mine fires, 9 were reported in Pennsylvania, 6 in West Virginia, 6 in Ohio, 2 each in Alabama and Kentucky, and 1 each in Colorado, North Dakota, Oklahoma, Tennessee, Utah, Virginia, and Wyoming. This number of coal-mine fires was the same as reported in the fiscal year 1944 and 12 more than the average number reported during the previous 15 years. The total of 71 fatalities equaled the total for the previous 8 years and contrasts severely with a total of 122 deaths from mine fires in the preceding 15 years.

Fourteen surface fires, including 8 at metal mines, were reported during the past fiscal year; these are not shown in table 8. Of the 6 fires that damaged or destroyed surface structures at coal mines 4 were of electrical origin, causing the loss of 2 fan installations, a washery and a tipple, the latter occurrence also involving a dust explosion; the other 2 fires resulted in the burning of tipples, 1 caused by a spark from a railroad locomotive and 1 by smoking. One metal-mine surface fire, thought to have been started in a bunk house by smoking in bed, cost the lives of 5 men; 4 fires of electrical origin, 2 from faulty oil-burning equipment and 1 from dumping carbide in an ore bin, resulted in the destruction of plants ranging in value from $5,000 to more than $1,000,000.

Generated on 2024-09-19 16:51 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 16:52 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

I.C. 7359 TABLE 9. - Summary of mine fires, by States, fiscal years 1945 and 1930-44, inclusive

State	Lighting used			Fatalities, by cause of ignition									
				Electricity		Open lights		Explosives		Unknown or miscellaneous		Total	
	Open	Closed	Unknown	Deaths	Fires	Deaths	Fires	Deaths	Fires	Deaths	Fires	Deaths	Fires
Alabama	1	1	-	-	1	-	-	-	1	-	-	-	2
Arizona	1	-	-	-	-	-	-	-	-	-	1	-	1 (met.)
Colorado	1	-	-	1	1	-	-	-	-	-	-	1	1
Kentucky	1	1	-	-	1	-	-	-	-	1	1	1	2
Minnesota	1	-	-	-	-	-	1	-	-	-	-	-	1 (met.)
Montana	-	1	-	-	1	-	-	-	-	-	-	-	1 (met.)
North Dakota	1	-	-	-	-	1	1	-	-	-	-	-	1
Ohio	1	5	-	67	4	-	1	-	1	-	-	67	6
Oklahoma	1	-	-	-	-	-	-	-	1	-	-	-	1
Pennsylvania	-	7	1/2	-	5	-	-	-	2	-	1/2	-	9
South Dakota	-	1	-	-	-	-	-	-	-	-	1	-	1 (met.)
Tennessee	-	1	-	-	1	-	-	-	-	-	-	-	1
Utah	1	1	-	-	1	-	-	-	-	-	1	-	2 (1 met.)
Virginia	-	1	-	-	1	-	-	-	-	-	-	-	1
West Virginia	-	6	-	1	6	-	-	-	-	-	-	1	6
Wyoming	-	1	-	-	-	-	-	-	-	-	1	-	1
Total 1945	9	26	2	69	22	1	3	-	5	1	7	71	37
1944	2	10	20	6	12	-	-	-	3	2	17	8	32
1943	8	7	12	13	6	-	-	-	1	2	20	15	27
1942	10	7	9	4	9	-	2	-	1	17	14	21	26
1941	3	8	5	2	7	-	-	-	3	-	6	2	16
1940	12	9	6	2	5	-	2	-	1	-	19	2	27
1939	9	9	2	1	8	-	1	-	3	2	8	3	20
1938	7	6	11	1	7	2	2	-	1	5	14	8	24
1937	7	4	10	9	5	-	-	-	3	2	13	11	21
1936	16	4	3	1	7	-	2	-	3	3	11	4	23
1935	7	5	14	11	11	-	1	-	-	-	14	11	26
1934	10	5	3	-	4	-	-	5	5	1	9	6	18
1933	12	6	9	-	7	-	-	-	2	2	18	2	27
1932	8	5	8	1	8	-	-	-	3	-	10	1	21
1931	12	7	5	-	7	5	3	-	5	18	9	23	24
1930	7	8	9	2	9	3	6	-	3	-	6	5	24
Total, 16 years.	139	126	128	122	134	11	22	5	42	55	195	193	2/393

1/ Outcrop fires, burning for several years. 2/ Includes 60 metal-mine fires and 14 outcrop fires.

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Underground metal-mine fires generally resulted in relatively little destruction of property but cost large sums to control or extinguish; one fire, however, burned out the shaft timbering and the head fram. Causes of these fires were welding, open lights, and electric power wires, and two in old stopes may have been caused by spontaneous combustion.

Of the 32 fires in coal mines during the fiscal year 1945, 20 were of electrical origin; 5 resulted from the use of nonpermissible explosives, 1 from smoking, and 1 from an open light; and 5 were of miscellaneous or unknown origin.

The worst disaster from a coal-mine fire since 1911 occurred in an Ohio mine, and cost the lives of 66 men. In 1911 a fire in an anthracite mine at Throop, Pa., caused the death of 72 men, and in 1909 the Cherry, Ill., mine fire killed 259. Since 1911 the largest number of fatalities from a single coal-mine fire, until this disaster in 1945, was 20 in another Ohio Mine. The fire that cost 66 lives in 1945 occurred through a fall of roof coal and rock on a trolley wire and gained much headway before a circuit breaker was pulled by hand. Although the arc between the wire and rail ignited the coal, it did not automatically throw out the circuit breaker. One hundred and ninety men were in the mine when the fire occurred; 66 were trapped inby the fire and, although 60 of them barricaded themselves, they were not rescued; the other 6 victims died in an attempt to get around the fire and escape. The fire area had to be sealed, and months elapsed before the fire was extinguished and the bodies recovered. The task of sealing this fire and later recovering the fire area was one of the most formidable in the history of coal mining in the United States.

The renewed efforts made to curb and eliminate foreseeable fire hazards in coal mines since the series of bad fires in 1943, 1944, and 1945 have in all probability had good results; however, actual determination of the extent of protection from these hazards will be shown by the records of the next several years.

Because of the highly combustible nature of coal, timber, explosives, and other materials usually present in coal mines, the fire hazard is always present in every coal mine, even when the mine is damp or wet or normally classed as nongassy. Spontaneous ignition of some coal, ores, and other materials is possible in coal or metal mines, in fact two coal-mine fires and two metal-mine fires in the past fiscal year may have originated from this cause. The ignition agencies that cause most fires are electricity, explosives, or open lights. Some companies continue to employ methods or equipment that have caused and continue to cause fires in their mines, although relatively safe methods and equipment have been devised. Included in the list of well-known causes of fires are the use of black powder and fuse; slipshod methods of installing, using, and maintaining electrical equipment; use of open lights; smoking; and other unsafe and out-of-date practices. One of the main sources of mine fires, particularly in recent years, is the trolley locomotive system, including both the locomotives and wiring adjuncts.

Generated on 2024-09-19 16:54 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

SUMMARY

1. From 1921 to 1940, inclusive, only 6 major disasters occurred from coal-mine fires, with a total of 42 deaths. In the fiscal year 1941 no major disasters due to fires occurred; in 1942, 10 men were killed in a fire in a Colorado mine and 5 in one in Pennsylvania; in 1943, a fire in a West Virginia mine killed 13 men; in 1944, a fire in a Pennsylvania mine resulted in 6 deaths; and 1945, the disastrous fire in the Ohio mine caused the death of 66 men. Evidently the coal-mine fire hazard has become more serious in the relatively recent past.

Where the necessary precautions are not taken, coal-mine fires may jeopardize the lives of many men who may be cut off from escape; moreover, those engaged in fighting any mine fire are at all times subject to grave hazards. The lack of knowledge of many mine officials as to prevention of mine fires as well as in the procedure for controlling them and an apparent indifference to the hazard resulting from them has been clearly shown by their action at several fires during recent years. Every mine should be provided with ample fire-fighting material placed at strategic places in the mine, and all persons at the mine should be instructed in the best procedure to follow in case of fire. However, of even more importance is keeping procedures and precautions in effect that prevent fires from starting.

2. The decrease in frequency and severity of mine explosions in the United States from 1924 to 1936 encouraged the expectation that these disasters might be virtually eliminated. The record of the fiscal year 1939 (in which there were no major explosions or fire disasters in the coal mines of the United States) was the best in the history of coal mining since it became a major industry; however, the increase in frequency and severity of explosions from 1940-43 demonstrated the need for more and better measures for protection against this danger. The somewhat improved record for 1944 and 1945 as to coal-mine explosions may be an indication that some effective measures are now being applied more widely; the fire record of recent years is by no means encouraging or even creditable. Ignorance of precautionary measures does not excuse either workers or management for their failure to prevent coal-mine explosions, as information on this subject has been given much publicity in the past two decades.

The number of explosions from electrical causes has not been materially reduced in the past 5 years; the number of such explosions and the conditions under which they occurred have shown neglect of suitable precautions in connection with the use of electrical equipment, and the unfitness of much of the equipment now employed for the conditions under which it is used.

Some significant points brought out by the Bureau of Mines study of explosions and fires in the United States during the fiscal year 1945 are:

1. Thirty-four coal-mine explosions, 7 of which were in anthracite mines, were studied as against 23 explosions in 1944 and an average of 25.3 explosions a year during the previous 16 years. This was an increase of 47.8 percent over the previous year and an increase of 34.4 percent compared with the average for the preceding 16 years.

Generated on 2024-09-19 16:54 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

2. Coal-mine explosions resulted in the loss of 64 lives during the fiscal year 1945, compared with 94 in 1944 and an average of 117.5 in the previous 16 years. This is a decrease of 31.9 percent for 1934 and of 45.5 percent from the average for the preceding 16 years. The anthracite mines of Pennsylvania had 7 explosions last year, 3 of these resulted in 1 fatality each, the others in injuries only.

3. The 4 major explosions in the fiscal year 1945 caused 45 deaths, compared with 5 major explosions and 81 deaths in 1944. Of the 4 major explosions in 1945, 3 occurred in mechanized mines; the other mine was operated on a cooperative basis, and only part of the coal was cut before it was shot. Three of the mines in which major explosions occurred were rock-dusted; in the other no rock dust was used. In 2 of the rock-dusted mines the explosion was confined by the rock dusting, and undoubtedly a large number of lives were saved because of the rock dusting; in the other, more efficient rock dusting probably would have confined the explosion more closely and some lives might have been saved. Rock-dusting to the recommended standards in the mine where none had been applied might have prevented the explosion or at least reduced the number of fatalities. Failure to rock-dust adequately any bituminous operating mine of today is inexcusable, as rock-dusting is inexpensive in comparison with the protection afforded and if kept up to standard, is almost certain to prevent widespread explosions.

During the year, 17 explosions occurred in which no deaths resulted, although at least 37 persons were burned or otherwise injured.

4. Six explosions occurred in open-light mines, compared with 6 in 1944 and an average of 8.5 in the preceding 16 years; 26 occurred in closed-light mines, as against 12 in 1944 and an average of 15.2 in the preceding 16 years. In the fiscal year 1945, as in former years, some of the explosions in closed-light mines were caused by open flame, such as use of matches in smoking and the misuse of flame safety lamps.

Five explosions with 4 deaths were reported to have been caused by smoking; year-by-year explosions of this type continue to occur in spite of the known danger and rules to prohibit even the carrying of matches and smoking materials in mines. One or more explosions in almost every year are caused by officials or others who attempt to relight their flame safety lamps with matches; at least one such explosion is known to have occurred in 1945. Three explosions during the year were caused by open lights. One explosion resulting in 23 deaths was probably caused by improper use of a flame safety lamp; 2 others with no deaths were ascribed to defective flame safety lamps. Unless used carefully the flame safety lamp is anything but a safety device.

5. Thirteen explosions, causing 20 deaths, were of electrical origin, compared with 11 such explosions and 59 deaths in the previous year and an average of 11.3 explosions and 67 deaths annually for the preceding 16 years. The use of electricity continues to increase, without due regard for restricting underground installations to tested and approved types and using and maintaining them in accordance with the required safe standards. Certainly the operation of nonpermissible equipment in places where gas and dust

Generated on 2024-09-19 16:53 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

accumulations are not carefully controlled invites explosions. Responsibility for maintaining the needed protection rests on both workers and supervisors.

6. Eleven explosions, with 17 deaths, were caused by explosives during the fiscal year 1945, compared with 3 and 1 death in 1944 and an average of 3.6 explosions and 19.5 deaths annually in the preceding 16 years. The large number of explosions from this cause in 1945 and the heavy loss of life compared with the preceding 4 years indicates that unsafe blasting methods still prevail in numerous coal mines. The use of dynamite or black blasting powder, either in granular or pellet form, in coal mines is a definite violation of established safe mining practice and will continue to be responsible for fatalities from fires, explosions, and other causes until it is eliminated by law or voluntary abandonment. Carelessness in using permissible explosives also is almost certain ultimately to result in disasters; in fact, carelessness in storage and use of explosives in and around coal mines is still evident, although many mines have greatly improved their practices in this respect in the last few years. The responsibility here again rests jointly with workers and management. Taking short cuts with explosives or relying on old traditions in using explosives in coal mines sooner or later results in death to those guilty of failing to get in line with safe, sensible procedures.

7. Of the explosions that occurred during the fiscal year 1945, 24 are thought to have been initiated by ignitions of gas and 9 by ignition of coal dust; 1 explosion was from gasoline vapor ignited by an open light. In almost all of the explosions initiated by gas, it was indicated that the ventilation current had been interrupted or was inadequate or was not directed properly, and in 10 cases the use of blower fans and tubing was involved; in perhaps 10 instances it was strongly indicated that inspection was inadequate and that the hazard of gas had been ignored.

Three of the gas explosions occurred in so-called nongassy mines. As has been the case scores of times in the past, the occurrence of these explosions again calls attention to the fact that all coal mines are potentially gassy, and many may become gassy unexpectedly. The mining laws of practically all of the States are wholly inadequate with respect to the classification of mines as gassy or nongassy; as a result, many mines are operated on a nongassy basis when it is known that they are, in fact, gassy, in that explosive gas is known to be given off. In many instances miners have resisted and continue to resist the introduction of permissible cap lamps and oppose or violate rules to prohibit smoking; in some cases this is done in the belief that the introduction of such equipment and rules would cause the operator to relax maintenance of adequate ventilation. Elimination of all possible sources of flame is necessary to prevent ignition of gas, and resistance to such elimination on the part of miners is an erroneous approach to the real solution of the problem; the logical procedure is to insist upon adequate ventilation and simultaneously to cooperate in taking suitable measures to eliminate sources of ignition, including the use of open lights or black blasting powder or dynamite and smoking.

Seven of the dust explosions that occurred during the year were caused by blown out shots; in six of these cases the explosive was black powder, in the other it was dynamite and permissible "on the solid." Another dust

Generated on 2024-09-19 16:55 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

explosion occurred from blasting "on the solid" with nonpermissible explosives; the other was caused by the ignition of a dust cloud by an electric arc during a "bump" which occurred immediately after blasting. This number of explosions due to unsafe blasting practices is to be expected as long as they are continued in as many mines as is now the case; the fact that only a very few explosions of this nature occurred between 1941 and 1944 can be ascribed only to good fortune.

8. The frequency of explosions during the past year (34) increased as compared with the previous year (23). The average number of deaths per explosion last year was 1.9, compared with 4.1 in 1944 and 4.7 for the preceding 16 years. The low severity rate for 1945 is due in part to several ignitions of relatively low violence in which fatal injuries did not result and also to the fact that the use of rock dust limited fatalities in some cases where explosions occurred.

9. The 34 explosions and 64 deaths during the fiscal year 1945 occurred in 11 States; 15 other coal-producing States are not known to have had explosions. The anthracite region had no major fire or explosion disaster during the fiscal year, although 7 known ignitions of gas caused 3 deaths.

10. The facts brought out by a study of the explosions that occurred during the past year stress the importance of allaying coal dust at its source. The 4 major explosions during the year were responsible for 70 percent of the fatalities resulting from explosions, and 2 of them were dust explosions, while at least 1 of the others was extended by coal dust. In 2 of these disasters certainly more adequate precautions to prevent spread of explosions would have saved lives. Mechanical mining of coal produces more fine dust than hand-loading methods, hence the need for allaying the dust at its source is greater now than in earlier years. Fine coal dust is an explosion and health hazard, and every possible precaution should be taken to suppress it at its source. The excellent practices in this regard now employed by several companies should be extended to all coal mines.

11. Rock dust was reported to have been used in only 15 of the 32 mines in which explosions occurred during the past year; a real effort had been made to do a good job in only a few of these nominally rock-dusted mines. The severity of major explosions during the past several years is good evidence of the inadequacy of rock-dusting practices generally in the coal mines of the United States; yet thorough rock-dusting costs only a very few cents per ton of coal.

12. During the fiscal year 1945, 32 coal-mine fires with 71 deaths were reported, compared with 32 fires and 8 deaths in 1944 and an average of 24 fires and 8 deaths annually for the preceding 15 years. Five other underground fires were also reported from metal mines, none of which caused deaths. Fourteen surface fires, 8 of which were at metal mines, were reported during the year.

13. Of the 37 fires during the year, 22 were of electrical origin, 5 were caused by explosives and 3 by open lights, and 7 were of miscellaneous or unknown origin.

Generated on 2024-09-19 16:52 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

14. The frequency and severity of mine fires during the past few years warn that these hazards still face the coal- and metal-mining industries and that the measures of control are far short of those to be expected from present day knowledge and experience. Most of the fires in coal mines have been of electrical origin, many of them caused by the trolley system. This emphasizes the need for careful installation and maintenance of underground electrical circuits and equipment. The terrible loss of life from the major fire disaster of the fiscal year in Ohio stresses the necessity of preparation in all mines to provide means for exit from mines and parts of mines where men might be trapped by being cut off from the regular route of travel. In addition to causing heavy loss of life, fires usually cause serious property damage and loss of production and almost invariably require considerable ultrahazardous effort in extinguishment or control. The potential hazard of fire in any mine is always serious, especially in coal mines, because a fire can precipitate an explosion. The definite fire hazard in virtually all mines should be recognized, and every feasible precaution should be taken to prevent fires. Also, plans should be placed in effect to handle fires quickly and safely if they occur, and underground officials and employees should be instructed in procedure to follow in case of fire, especially if they are trapped behind a mine fire.

This circular was compiled in essentially the same manner as were those of previous years (see Information Circulars 6178, 6419, 6540, 6680, 6819, 6870, 6761, 6927, 6986, 7048, 7092, 7136, 7208, 7274, and 7330) and embodies only facts revealed by studies of field employees of the Health and Safety Branch of the Bureau of Mines. The Bureau of Mines attempts to obtain information concerning every explosion and most of the fires in mines of the United States. Although some of the less-destructive mine explosions and fires may not have been brought to the Bureau's attention early enough to permit investigation, it rarely fails to obtain fairly complete details of mine explosions or fires in which more than one life has been lost or in which considerable property has been damaged; therefore, the data in these publications are relatively complete.

A study of available data on mine explosions in the United States during the past 17 years reveals that there was an encouraging reduction in the frequency and severity of such disasters until 1940; however, the record was not so encouraging during the next 5 years, though that for the fiscal year 1945 was the best since 1939. Explosions in mines in the United States have resulted in an average of 114 fatalities annually during the past 17 years, compared with 64 fatalities in 1945, 94 in 1944, 152 in 1943, 152 in 1942, 163 in 1941, and 206 in 1940.

The undue prevalence of major coal-mine explosions and fires during the past 6 years indicates lack of effective precautions to prevent such disasters. Three of the four major explosions in 1945 occurred in mechanized mines. In two of the major explosions in which 13 men were killed, electricity is believed to have been the initiating cause; and the other, in which 23 were killed, was caused by officials attempting to move an accumulation of gas. In most of the mines in which explosions occurred, numerous unsafe practices were followed; some evidently were the result of a lack of respect (possibly a lack of knowledge) for the hazard of gas and others were due to neglect to

Generated on 2024-09-19 16:56 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

necessary yet readily applicable safety measures, such as the elimination of the sources of ignition of gas or dust.

The more rapid extraction of coal with mechanical methods calls for much greater ventilating efficiency, and unless ventilation is so maintained that enough fresh air reaches all working faces to dilute the gases, explosions are certain to continue to occur. In nearly every instance of explosions initiated by ignitions of gas, some deficiency in ventilation has come to light. Consequently, ventilation must be made more effective, and greater vigilance must be maintained in detecting gas and in eliminating or neutralizing dust, as well as in eliminating ignition agencies. Many explosions result directly or indirectly from carelessness or infraction of rules by employees; therefore, the prevention of explosions is the responsibility not only of management but of the workers as well. Irrespective of responsibility, the seriousness of the situation brought about by the very bad coal-mine-explosion record of the past 6 years cannot be questioned.

The lessons of the several coal-mine fire disasters of the past 4 years must be heeded, and where protective measures against the hazards revealed are plain to be seen, the studies of the committees now working on these problems should be carried through to provide the industry and all men working in the mines with information to allow safe working conditions to be provided. Some of the problems to which better solutions are being sought are: Hazards of fires from electrical circuits, especially trolley wires and trailing cables; emergency escapeways for mine workers from advanced sections of a mine; and (of first importance) training of workers and officials in methods to protect and remove employees from danger zones and in effective fire-fighting procedures.

Generated on 2024-09-19 16:53 GMT / https://hdl.handle.net/2027/osu.32435030643860
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY